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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/750,969	01/05/2004	Yair Ein-Eli	27054	4539

7590
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05/16/2007

EXAMINER

SMITH, NICHOLAS A

ART UNIT	PAPER NUMBER
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1742

MAIL DATE	DELIVERY MODE
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05/16/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/750,969

Applicant(s)

EIN-ELI ET AL.

Examiner

Nicholas A. Smith

Art Unit

1742

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 March 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-101 is/are pending in the application.
- 4a) Of the above claim(s) 18, 19, 70 and 93-103 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-17, 20-69 and 71-92 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Claims 93-101 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 1 March 2007.
2. Claims 18, 19 and 70 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 15 March 2007.

Status of Claims

3. Claims 1-17, 20-69 and 71-92 remain for examination.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claims 1-2, 7-9, 11-14, 16, 17, 22, 25, 27-30, 35-36, 38-39, 41 and 44-49 are rejected under 35 U.S.C. 102(a) as being anticipated by Ein-Eli et al, "Silicon Texturing In Alkaline Media Conducted Under Extreme Negative Potentials," *Electrochem. & Solid State Letters*, 6(3):C47-C50, 2003 as submitted on 2 November 2004 in Applicant's Information Disclosure Statement.

Art Unit: 1742

6. In regards to claim(s) 1, 22, 25, 27-30, 35-36, 38-39, 41 and 44-49, Ein-Eli et al. discloses a method for texturing a semiconductor material, comprising exposing and immersing the semiconductor material in an alkaline etching solution under the claimed process variable conditions, negatively biasing the semiconductor material to a potential more than 60 volts relative to standard reference electrode, illuminating the semiconductor material while negatively biasing for a period of time such that value of cathodic current density of the semiconductor material is significantly higher at end of illumination time period than at beginning of time period (as shown, Figures 1-2, pp. C47-C48).

7. In regards to claim(s) 2, 7-9, 11-14 and 16, Ein-Eli et al. discloses the claimed order of magnitude and grade, monocrystalline, <100>, doped p-type Si (pp. C47-C48).

8. In regards to claim(s) 17, Si is just described as a wafer and does not mention patterning, thus it is inherently non-masked (C47).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 3-6, 10, 15, 23-24, 26, 31, 40 and 42-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ein-Eli et al. in view of Starosvetsky et al. (US 6,521,118).

Art Unit: 1742

11. In regards to claims 3-6,10 and 15, Ein-Eli et al. does not specifically disclose , film construction, an instantly claimed alloy or an instant claimed metal oxide or sulfide as semiconductor material.

12. Starosvetsky et al. discloses etching of semiconductor materials using negative potential dissolution (NPD) (abstract). Starosvetsky et al. discloses cathodic dissolution of an instantly claimed alloy, an instant claimed metal oxide or sulfide, variable doping and crystallinity, and film construction (col. 1, lines 48-53; col. 4, line 66 to col. 5, line 11; Examples 1 and 7). It would have been obvious to one of ordinary skill in the art to modify Ein-Eli et al.'s method with Starosvetsky et al.'s semiconductor material because Starosvetsky et al. teaches that it is desirable to etch three-dimensional structures in semiconductor materials (Starosvetsky et al., col. 2, lines 3-9).

13. In regards to claim(s) 23-24, 26, 31, 40 and 42-43, Ein-Eli et al. does not specifically disclose the instant claimed electrolytes and etching conditions.

14. Starosvetsky et al. discloses the instant claimed electrolytes and etching conditions (col. 2, line 27-31; col. 4, lines 60-65; col. 5, lines 12-20, lines 26-28; Examples 1, 5 and 7). It would have been obvious to one of ordinary skill in the art to modify Ein-Eli et al.'s method with Starosvetsky et al.'s electrolyte because Starosvetsky et al. teaches that it is desirable to etch three-dimensional structures in semiconductor materials (Starosvetsky et al., col. 2, lines 3-9).

15. Claims 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ein-Eli et al. in view of Sato (US 6,413,874).

Art Unit: 1742

16. In regards to claim(s) 20, Ein-Eli et al. does not specifically disclose the substrate being in as-cut or unpolished form. It is noted that the substrate would be either in polished or unpolished form.

17. Sato discloses etching a semiconductor material that is unpolished (claim 4). It would have been obvious to one of ordinary skill in the art to modify Ein-Eli et al.'s method by using an unpolished semiconductor material because Sato teaches that it is desirable smooth the surface to by etching of a semiconductor article (Sato, col. 8, lines 26-32).

18. Claims 21, 32-34, 37 and 50-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ein-Eli et al.

19. In regards to claim(s) 21, Ein-Eli et al. does not specifically disclose the step of using the semiconductor material for manufacturing a solar cell, but such a use is described in the general disclosure of Ein-Eli et al. (p. C47).

20. In regards to claim(s) 32-34, Ein-Eli et al. does not specifically disclose the instant claimed ranges of etchant flow rate. However, Ein-Eli et al. discloses circulation of the electrolyte using a pump that is generally noted to be operable in the claimed flow rate ranges (p. C47) and overlaps the instant claims flow rate ranges therefore establishing a case of prima facie obviousness. See MPEP 2144.05. It would have been obvious to one of ordinary skill in the art to select the claimed ranges from the prior art's entire range of flow rates because Ein-Eli et al. teaches those flow rates have the same utility over the entire range (p. C47).

Art Unit: 1742

21. In regards to claim(s) 37, Ein-Eli et al. does not specifically disclose a voltage of greater than -100 V ; however, as seen in Figure 2, -100 V is used and thus is very close to -100.01 V (a voltage greater than -100 V); there is no patentable distinction between value that are so close unless criticality or unexpected results can be shown.

22. In regards to claim(s) 50-52, Ein-Eli et al. does not specifically discloses an embodiment of the instantly claimed time periods, however discloses a method comprising at least the amount of time illuminated (Figure 1, i.e., additional illumination may occur).

23. Claim 53-69 and 71-92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ein-Eli et al. in view of Sato.

24. Ein-Eli et al. in view of Sato discloses the claimed method as stated above in paragraphs 6, 16 and 17. Furthermore, Ein-Eli et al. discloses a method wherein the illumination is less than $0.01\text{ watts per cm}^2$ (Figure 2; Table I). Ein-Eli et al. does not specifically disclose the value of current density as a function of time with the claimed initial rise to a maximum and subsequent decreases to a series of values each being significantly less than said maximum value. However, since Ein-Eli et al. in view of Sato has the same active method steps (i.e., applying a negative bias for a period of time), thus claimed current response would be inherent to Ein-Eli et al. in view of Sato's method, thus meeting the claimed limitation.

25. In regards to claim(s) 53-69 and 71-91, please see reasons stated above in paragraphs 6-8, 11-14, 16-17 and 19-22.

Art Unit: 1742

26. In regards to claim(s) 92, see reasons stated above in paragraphs 6, 16, 17 and 24.

27. Claims 1-2, 7-9, 11-14, 16, 17, 22, 25, 27-30, 35-36, 38-39, 41 and 44-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starosvetsky et al., "Environmentally Friendly, Fast Electrochemical Etching of Silicon", *Electrochemical Society Proceedings*, Proceedings Vol. 2002-14, pp 286-29 (Starosvetsky et al.'*Electro*) as submitted on 2 November 2004 in Applicant's Information Disclosure Statement.

28. In regards to claim(s) 1, 22, 25, 27-30, 35-36, 38-39, 41 and 44-49, Starosvetsky et al.'*Electro* discloses a method for texturing a semiconductor material, comprising exposing and immersing the semiconductor material in an alkaline etching solution under the claimed process variable conditions, negatively biasing the semiconductor material, illuminating the semiconductor material while negatively biasing for a period of time (pp. 287-288 and 294). Starosvetsky et al.'*Electro* does not specifically disclose value of cathodic current density of the semiconductor material is significantly higher at end of illumination time period than at beginning of time period. However, since Starosvetsky et al.'*Electro* has the same active method steps (i.e., applying a negative bias for a period of time), thus claimed current response would be inherent to Starosvetsky et al.'*Electro*'s method, thus meeting the claimed limitation.

29. However, Starosvetsky et al.'*Electro* does not specifically disclose negative bias to a potential more than 60 relative to standard reference electrode. Starosvetsky et al.'*Electro* shows that -60 V is used and thus is very close to -60.01 V (a voltage

Art Unit: 1742

greater than -60V); there is no patentable distinction between value that are so close unless criticality or unexpected results can be shown.

30. In regards to claim(s) 2, 7-9, 11-14 and 16, Starosvetsky et al.' *Electro* discloses the claimed order of magnitude and grade, monocrystalline, <100>, doped p-type Si (pp. 287-288).

31. In regards to claim(s) 17, Starosvetsky et al.' *Electro* discloses Si as a wafer and does not mention patterning, thus it is inherently non-masked (p. 287).

32. Claims 3-6, 10, 15, 23-24, 26, 31-34, 40 and 42-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starosvetsky et al.' *Electro* in view of Starosvetsky et al. (US 6,521,118).

33. In regards to claims 3-6, 10 and 15, Starosvetsky et al.' *Electro* does not specifically disclose , film construction, an instantly claimed alloy or an instant claimed metal oxide or sulfide as semiconductor material.

34. Starosvetsky et al. discloses etching of semiconductor materials using negative potential dissolution (NPD) (abstract). Starosvetsky et al. discloses cathodic dissolution of an instantly claimed alloy, an instant claimed metal oxide or sulfide, variable doping and crystallinity, and film construction (col. 1, lines 48-53; col. 4, line 66 to col. 5, line 11; Examples 1 and 7). It would have been obvious to one of ordinary skill in the art to modify Starosvetsky et al.' *Electro*'s method with Starosvetsky et al.'s semiconductor material because Starosvetsky et al. teaches that it is desirable to etch three-dimensional structures in semiconductor materials (Starosvetsky et al., col. 2, lines 3-9).

Art Unit: 1742

35. In regards to claim(s) 23-24, 26, 31, 40 and 42-43, Starosvetsky et al.' *Electro* does not specifically disclose the instant claimed electrolytes and etching conditions.

36. Starosvetsky et al. discloses the instant claimed electrolytes and etching conditions (col. 2, line 27-31; col. 4, lines 60-65; col. 5, lines 12-20, lines 26-28; Examples 1, 5 and 7). It would have been obvious to one of ordinary skill in the art to modify Starosvetsky et al.' *Electro*'s method with Starosvetsky et al.'s electrolyte because Starosvetsky et al. teaches that it is desirable to etch three-dimensional structures in semiconductor materials (Starosvetsky et al., col. 2, lines 3-9).

37. In regards to claim(s) 32-34, Starosvetsky et al.' *Electro* does not specifically disclose the instant claimed ranges of etchant flow rate.

38. Starosvetsky et al. discloses circulation of the electrolyte using a pump that is generally noted to be operable in the claimed flow rate ranges (col. 6, lines 7-23) and overlaps the instant claims flow rate ranges therefore establishing a case of prima facie obviousness. See MPEP 2144.05. It would have been obvious to one of ordinary skill in the art to modify Starosvetsky et al.' *Electro*'s method with Starosvetsky et al.'s electrolyte flow because flow control is preferable (Starosvetsky et al., col. 6, lines 7-23). It would have been obvious to one of ordinary skill in the art to select the claimed ranges from the prior art's entire range of flow rates because Starosvetsky et al. teaches those flow rates have the same utility over the entire range (Starosvetsky et al., col. 6, lines 7-23).

39. Claims 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Starosvetsky et al.' *Electro* in view of Sato (US 6,413,874).

Art Unit: 1742

40. In regards to claim(s) 20, Starosvetsky et al.' *Electro* does not specifically disclose the substrate being in as-cut or unpolished form. It is noted that the substrate would be either in polished or unpolished form.

41. Sato discloses etching a semiconductor material that is unpolished (claim 4). It would have been obvious to one of ordinary skill in the art to modify Starosvetsky et al.' *Electro*'s method by using an unpolished semiconductor material because Sato teaches that it is desirable smooth the surface to by etching of a semiconductor article (Sato, col. 8, lines 26-32).

42. Claims 21 and 50-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starosvetsky et al.' *Electro* in view of Vazsonyi et al., "Improved Anisotropic Etching Process for Industrial Texturing of Silicon Solar Cells", *Solar Energy Materials & Solar Cells*, 57:179-188, 1999 as submitted on 2 November 2004 in Applicant's Information Disclosure Statement.

43. In regards to claim(s) 21, Starosvetsky et al.' *Electro* does not specifically disclose the step of using the semiconductor material for manufacturing a solar cell.

44. Vazsonyi et al. discloses using the semiconductor material for manufacturing a solar cell (p. 180). It would have been obvious to one of ordinary skill in the art to modify Starosvetsky et al.' *Electro*'s method with a step of using as a solar cell because texturing of a Si wafer is an effective means of reducing reflectivity from the front surface of a solar cell (Vazsonyi et al., p. 180).

45. In regards to claim(s) 50-52, Starosvetsky et al.' *Electro* does not specifically disclose an embodiment of the instantly claimed time periods.

Art Unit: 1742

46. Vazsonyi et al. discloses that the etching rate defines the texturing of a silicon surface (p. 180). It would have been obvious to one of ordinary skill in the art to modify Starosvetsky et al.' *Electro*'s method with Vazsonyi's etching rate to achieve the proper amount of texturing as it is recognized as a result-effective variable (Vazsonyi et al., p. 180). Furthermore, it would have been obvious to one of ordinary skill in the art that if etching rate is a result-effective variable then etching time period is also a results-effective variable. Therefore, it would have been obvious to one of ordinary skill in the art to select the etching time in order to optimize texturing of the surface. See MPEP 2144.05.

47. Claim 53-69 and 71-92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starosvetsky et al.' *Electro* in view of Sato.

48. Starosvetsky et al.' *Electro* in view of Sato discloses the claimed method as stated above in paragraphs 28-29 and 40-41. Furthermore, Starosvetsky et al.' *Electro*. discloses a method wherein the illumination is less than 0.01 watts per cm² (Figure 4; p. 292). Starosvetsky et al.' *Electro* does not specifically disclose the value of current density as a function of time with the claimed initial rise to a maximum and subsequent decreases to a series of values each being significantly less than said maximum value. However, since Starosvetsky et al.' *Electro* in view of Sato has the same active method steps (i.e., applying a negative bias for a period of time), thus claimed current response would be inherent to Starosvetsky et al.' *Electro* in view of Sato's method, thus meeting the claimed limitation.

49. In regards to claim(s) 53-69 and 71-91, please see reasons stated above in paragraphs 28-31, 33-38, 40-41 and 43-46.

50. In regards to claim(s) 92, see reasons stated above in paragraphs 28-29, 40-41 and 48.

Conclusion

51. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicholas A. Smith whose telephone number is (571)-272-8760. The examiner can normally be reached on 8:30 AM to 5:00 PM, Monday through Friday.

52. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571)-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

53. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.


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